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PHASE I UNDERGROUND TANK
LEAK INVESTIGATION REPORT
FOR DOUGLAS AIRCRAFT COMPANY'S
C6 FACILITY
LOS ANGELES, CALIFORNIA

Prepared for:

Douglas Aircraft Company
3855 Lakewood Boulevard
Long Beach, California 90844

Project No. 41863B
June 1987

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PHASE I UNDERGROUND TANK LEAK INVESTIGATION REPORT
FOR DOUGLAS AIRCRAFT COMPANY'S C6 FACILITY
LOS ANGELES, CALIFORNIA

1.0 INTRODUCTION

As part of the on-going underground tank leak investigation for Douglas Aircraft Company (DAC), Woodward-Clyde Consultants installed and sampled soil borings in the vicinity of Tanks 19T and 20T at Douglas' Los Angeles, California C6 Facility (Figure 1). The purpose of the boring program was to evaluate the leakage that resulted from the underground piping associated with tanks 19T and 20T.

This report contains the investigation procedures, the results of the sample analysis, a discussion of the results, and recommendations for further steps.

2.0 SITE HYDROGEOLOGY

The Douglas Aircraft C6 Facility, located on the Torrance Plain of the Los Angeles Coastal Basin, is underlain by the Lakewood Formation. The primary aquifers beneath the site are the "Semi-Perched" and the Gage. The following is a description of the aquifers and the aquicludes beneath the site.

2.1 "Semi-perched" Aquifer

The "Semi-perched" Zone is a coarse sand and gravel aquifer that varies in thickness from 0 to 60 feet. It occurs near the surface throughout much of the coastal plain, but is very irregular in occurrence. It is mainly comprised of stream sediments, although it also consists of marine deposits beneath the Torrance Plain. (Marine deposits have been identified in the borings at the C6 Facility.) Wells in the "Semi-perched" zone yield small quantities of poor quality water, which is of little beneficial use.

2.2 Bellflower Aquitard

The "Semi-perched" Zone is underlain by the Bellflower Aquitard, which separates this zone from the underlying Gage Aquifer. The Bellflower Aquitard consists of low permeability, fine grained sediments, and acts as a confining unit on the underlying Gage Aquifer. The Bellflower is a heterogeneous mixture of continental and marine sediments, and also contains sand and gravel lenses. It varies in thickness from 0 to 200 feet and may be approximately 60 to 80 feet thick in the site area.

2.3 Gage Aquifer

The lowest member of Lakewood Formation, the Gage Aquifer, is also known as the "200 foot sand". It extends over most of the Coastal Plain. In the site vicinity it consists of coarse sand and gravel, and from an evaluation of the regional data appears to be approximately 40 to 80 feet thick.

2.4 Site Specific Interpretation

The C6 site is approximately 50 feet above Mean Sea Level. The uppermost 200 feet of the subsurface consists of the Lakewood Formation and contains the "Semi-perched" and Gage Aquifers, separated by the Bellflower Aquitard. Regional

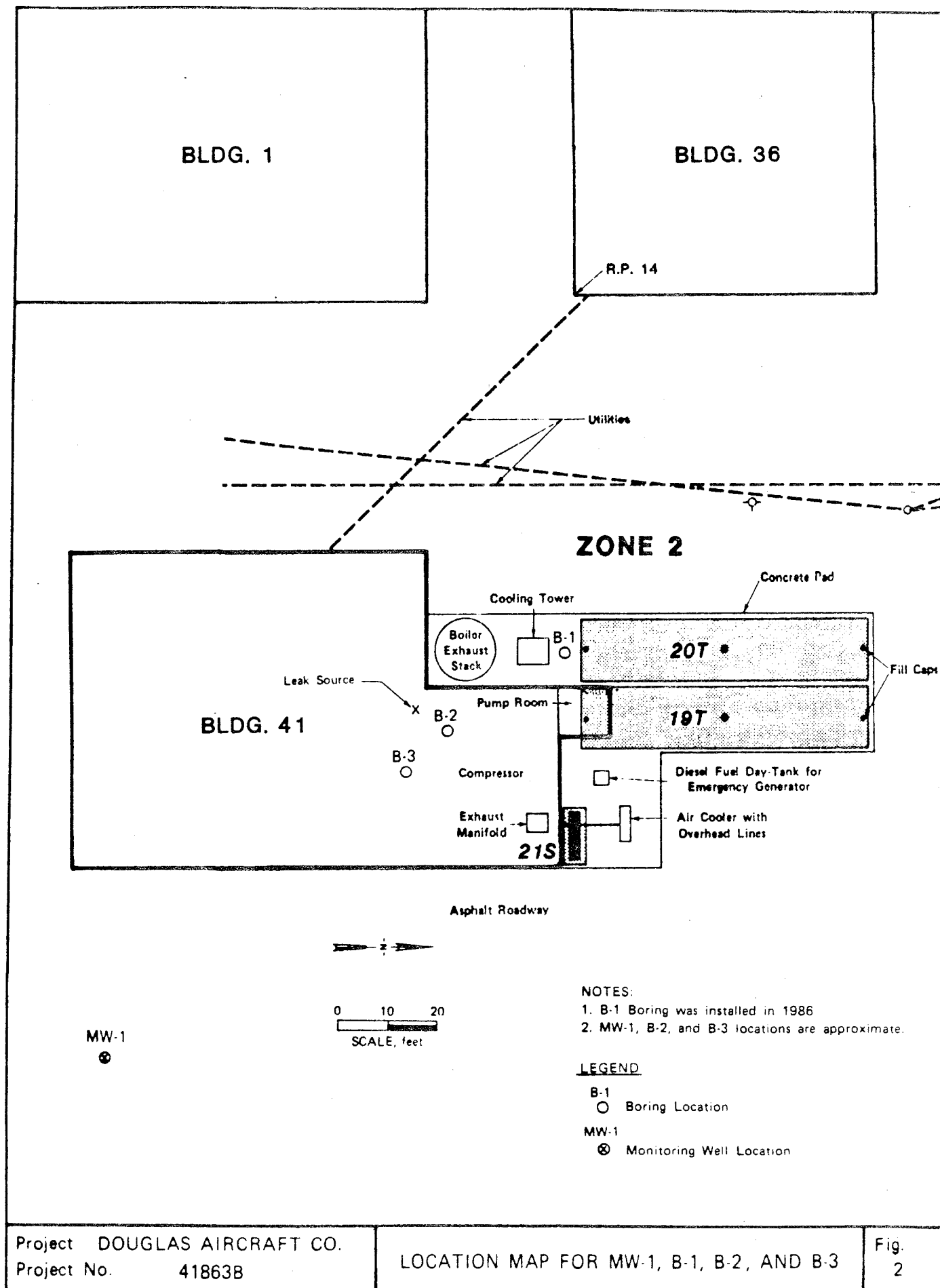
information suggests the base of the Gage may be approximately 150 feet below Mean Sea Level or about 200 feet below the ground surface. Therefore, based on an estimated aquifer thickness of 40 to 80 feet, the top of the Gage Aquifer is about 120 to 160 feet below the ground surface. The "Semi-perched" Aquifer occurs about 70 to 80 feet below the ground surface, based on the information obtained from the well installed by Woodward-Clyde Consultants at the C6 Facility. Regional data suggests that the "Semi-perched" Zone may be approximately 20 feet thick beneath the site.

3.0 FIELD INVESTIGATION TASK WORK

Field work occurred on 10 April 1987. Three borings (B1, B2, and B3) and one observation well (MW1) were drilled in the vicinity of Tanks 19T and 20T. The approximate locations of the borings are shown in Figure 2. Boring B1 was installed in April 1986 during an earlier phase of this investigation.

Drilling was accomplished using an 8-inch hollow stem auger equipped with a modified California sampler. Observations of soil type were made using the Unified Soil Classification System. Sample collection location, type of drilling equipment, organic vapor readings in the soil, and pertinent comments of the field geologist were recorded on Boring Logs. The Boring Logs are attached as Appendix A.

Cuttings from each borehole were collected in 55-gallon drums. These drums were labelled as to contents, boring identification, and depth and date of collection of cuttings.



Soil samples were collected from each boring. These samples were collected at 5-foot depths, beginning at a depth of five feet. The soil samples were sealed in brass tubes and labelled with project number, boring number, depth, sample number, date, and name of sampler.

Water samples were collected for analysis of volatile organics. Evidence of elevated fuel oil concentrations was not found in soil samples collected from this boring and screened by using an OVA.

4.0 RESULTS AND CONCLUSIONS

Soil and water sample analyses were performed by West Coast Analytical Service, Inc. located in Santa Fe Springs, California. The analytical results are presented in Tables 4.1 and 4.2. Appendices B and C contain copies of the original laboratory results and chain-of-custody forms.

The soil chemical analysis indicates the presence of petroleum hydrocarbon in samples from Borings B2 and B3. Hydrocarbon concentrations of 19,000 ppm were detected as deep as 50 feet below ground surface.

The water samples collected from observation Well MW-1 contained 1,1-dichloroethene, 1,1,1-trichloroethane and trichloroethene. Benzene was also detected as shown on Table 4.2.

TABLE 4.1

SOIL ANALYSIS FOR BORINGS B2 AND B3

Sample No.	Depth (ft)	Total Petroleum Hydrocarbon (ppm)
B2-2-3	10	5,000
B2-7-3	30	6,000
B2-7-4	35	14,000
B2-8-4	42	2,000
B2-9-4	47	2,000
B2-10-4	50	19,000
B3-1-4	5	2,900
B3-2-4	10	27
B3-3-4	15	1,200
B3-4-4	20	4,400
B3-5-3	25	13,000
B3-6-3	30	4,100

Borings are near tanks 19T and 20T at C6 Facility

TABLE 4.2

ORGANICS ANALYSIS DATA RESULTS OF
MW-1 WATER SAMPLES
(EPA Method 8240)

	1,1- Dichloro- ethene (ppb)	1,1,1-Trichloro- ethane (ppb)	Trichloro- ethene (ppb)	Benzene (ppb)
<hr/>				
4/15/87				
MW-1,A	3700	260	5500	110
MW-1,B	2500	120	3600	ND
4/1/87				
MW-1(41)A	2800	300	4000	85

The presence of solvents in the ground water does not appear to be the result of the leak associated with Tanks 19T and 20T. The leak from Tanks 19T and 20T was a diesel leak, and would not be expected to produce halogenated solvents at the concentrations present in the ground water.

The fuel oil concentrations in the soil near Tanks 19T and 20T have apparently resulted from the leak of diesel in this area. The fuel oil is present in the soil to a depth between 50 and 70 feet near the source, with lateral spreading estimated at up to 30 feet.

5.0 RECOMMENDATIONS

The results obtained from the field investigation indicated that fuel oil is present in the soil in the vicinity of Tanks 19T and 20T. However, the compounds present in the ground water are apparently not due to the release of fuel oil. Therefore, it is recommended that further investigation be implemented to delineate the extent of the solvents in the ground water and identify the source(s) of these solvents.

The planned investigation would at a minimum entail the following:

- Installation of an additional boring near the source of the fuel oil release. This boring would be used to evaluate whether the fuel oil had reached ground water, by sampling between 50 feet and 65 feet.
- Installation of three additional observation wells around Tanks 19T and 20T, to evaluate whether these tanks are (were) the source of the solvents in the ground water.

APPENDIX A

BORING LOGS

BORING LOCATION MW-1 (41)		ELEVATION AND DATUM N/A	
DRILLING AGENCY Datum Exploration, Inc.		DRILLER James	
DRILLING EQUIPMENT Mobile Drill B-61, 10-inch O.D., H.S.A.		DATE STARTED 3-25-87	
DIAMETER AND TYPE OF WELL CASING 2-inch Plastic, Flush Threaded		DATE FINISHED 3-26-87	
TYPE OF PERFORATION .02 Slot		COMPLETION DEPTH (FT) 91	
TYPE OF BACKFILL No. 12 Silica Sand		NO. OF SAMPLES 5	
TYPE OF SEAL Bentonite Pellet Plug and Bentonite Grout		DIST. 5	
		WATER FIRST DEPTH (FT) 74.5	
		LOGGED BY S. Donaldson	
		CHECKED BY B. Jacobs	

DEPTH (FEET)	DESCRIPTION	Lithology	Observation Well	SAMPLES					REMARKS
				No.	Type	Blow Count	Drilling Rate/Time		
	Asphalt						0905		Background OVA reading = 1-2 ppm
	Damp, reddish-brown, SILTY SAND (SP) with clay and gravel. Becomes black								
5	Becomes reddish brown, no gravel.								
10	Becomes medium brown.								
	CLAYEY SAND (SC)						0915		
15									
20									
25	Stiff, damp, medium brown, CLAYEY SILT (ML) with some fine sand.								
30									
	Becomes hard with more clay.						0920		
35									
	Lense of volcanic (?) angular gravel.								

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Project No.: 41863B

LOG OF BORING MW-1(41)

Fig.
A-1

WOODWARD-CLYDE CONSULTANTS

LA/OR-0783 235R

BOE-C6-0092050

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG			SAMPLES				REMARKS
		Lithology	Observations Well	OVA (ppm)	No.	Type	Blow Count	Drilling Rate/Time	
	Lense of volcanic (?) angular gravel (continued).								
40								0930	
	↓ Becomes moist and hard.								
45					1	×	59		
	Very hard, moist, dark brown, SILTY CLAY (CL).								
50									
	Lenses of very hard, carbonate cemented concretions.				1 2	×	26		
55								1010	
60	↓ Increasing silt.								
	Medium dense, dry, tan, fine SAND (SP).				7.5 3	×	57		
65									
	Dense, dry, whitish-tan, fine SAND (SP).								
70	↓ Becomes damp and very dense.				2.5 4	×	50/ 5"		
	Very stiff, damp, dark brown SILT (ML).								
75	↓ Becomes wet.				7.8 5	×	50/ 5"		
	Very dense, wet, brown, fine SAND (SP).								Water encountered at 74.5 feet.

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CONT. LOG OF BORING MW-1(41)

Fig.
A-2

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG				SAMPLES				REMARKS
		Lithology	Observation Well	OVA (ppm)	No.	Type	Blow Count	Drilling Rate/ Time		
	Very stiff, wet, dark brown SILT (ML) (continued).									
	Very dense, wet, brown, fine SAND (SP).				12	⊗	6			
80										
85										
90	Stiff, moist, dark brown, SILTY CLAY (CL).									
	Bottom of Boring at 91 feet.									
95										
100										
105										
110										
115										

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Project No.: 41863B

CONT. LOG OF BORING MW-1(41)

Fig.
A-3

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Project No.: 41863B

CONT. LOG OF BORING MW-1(41)

Fig.
A-3

BORING LOCATION Boiler Room At T-19, 20 (C-6 Facility)		ELEVATION AND DATUM Approximately 52 Feet MSL	
DRILLING AGENCY Datum Exploration, Inc.	DRILLER Kit Stephens	DATE STARTED 12/29/86	DATE FINISHED 1/5/87
DRILLING EQUIPMENT Simco 2400SK, Datum D27-L (Dietrich Gasoline Engine)		COMPLETION DEPTH (FT) 51'	ROCK DEPTH (FT) -
DIAMETER AND TYPE OF WELL CASING 6" Hollow Stem Auger; No Casing in Installed		NO. OF SAMPLES -	DIST. -
TYPE OF PERFORATION N/A		WATER FIRST DEPTH (FT) -	UNDIST. 20
TYPE OF PERFORATION N/A		LOGGED BY Jacobs/ Donaldson/ Gibson	CORE -
BACKFILL Concrete, #60 Silca Sand (85%) and Bentonite (15%)		CHECKED BY Sd	24 HRS -

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG		SAMPLES					REMARKS
		Unconsolidated	Consolidated	OVA (Feet)	No.	Type	Blow Count	Drilling Rate/Time	
	Concrete and pea gravel.								Hydrocarbon odor
5	Stff, damp, olive to brown SILTY CLAY (CL-CH).			250	1	X	NR		
				300	2	X	NR		Hydrocarbon odor and staining throughout boring.
10				140	3	X	NR		
15	Becomes olive to dark olive green.			440	4	X	NR		
20				>1000	5	X	NR		
25				560	6	X	NR		
30	Gravel lense (to 2" Ø).			460	7	X	NR		Drilling difficult. Stop drilling.
	Becomes hard and grey, sandy, and thinly laminated.								Commence drilling at 31' on 1/5/87 with datum D27-L rig.
35	Becomes silty.			>1000	7	X	75		

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Project No.: 418638

LOG OF BORING B-2

Fig. A-4

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG			SAMPLES				REMARKS
		Lithology	Observation Well	OVA (ppm)	No.	Type	Blow Count	Drilling Rate/Time	
40				560	8	X	66		
45				400	9	X	53		
50				>1000	10	X	90		
	Bottom of Boring at 51 Feet.								
55									
60									
65									
70									
75									
80									

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Project No.: 41863B

CONT. LOG OF BORING B-2

Fig.
A-5

BORING LOCATION Boiler Room at T-19, 20 (C-6 Facility)		ELEVATION AND DATUM Approximately 52 Feet MSL	
DRILLING AGENCY Datum Exploration, Inc	DRILLER Kit Stephens	DATE STARTED 1/6/87	DATE FINISHED 1/6/87
EQUIPMENT Datum D27-L (Dietrich Gasoline Engine)		COMPLETION DEPTH (FT) 31'	ROCK DEPTH (FT) -
DIAMETER AND TYPE OF WELL CASING 6" Hollow Stem Auger; No Casing Installed		NO. OF SAMPLES -	DIST. - UNDIST. 12
TYPE OF PERFORATION N/A		WATER FIRST DEPTH (FT) None	COMPL. - 24 HRS
TYPE OF PERFORATION N/A		LOGGED BY: S. Donaldson	CHECKED BY: Sd
BACKFILL Concrete, #60 Silca Sand (85%) and Bentonite (15%)			

DEPTH (FEET)	DESCRIPTION	GRAPHIC LOG			SAMPLES			REMARKS
		Lithology	Observation Well	NOVA (ft/min)	No.	Type	Blow Count	
5	Concrete							
	Dense, damp, light grey, fine SAND (SP) with FeO ₂ staining and hydrocarbon odor.							
	Stiff, damp, dark brown SILTY CLAY (CL-CH).							
10	Gravel lense ($\leq 2'' \varnothing$). Becomes hard.				310	1	48	
					105	2	30 50/ 5"	
15	Medium dense, damp, grey CLAYEY SAND (SC) strong hydrocarbon odor.				62	3	27	Easier drilling
20	Becomes dense and greyish brown.				350	4	47	
25	Becomes very dense, grey, more SANDY (SC-SP).				260	5	65	
30	Bottom of Boring at 31 Feet.				340	6	66	
35								

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Project No.: 41863B

LOG OF BORING B-3

Fig. A.6

APPENDIX B

CHEMICAL ANALYSIS RESULTS

April 16, 1987

WOODWARD-CLYDE
203 N. Golden Circle Drive
Santa Ana, CA 92705

Attn: Allistair Callendar

JOB NO. 5677

WCAS

**WEST COAST
ANALYTICAL
SERVICE, INC.**


ANALYTICAL CHEMISTS

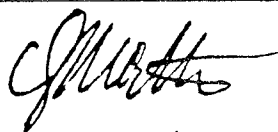
LABORATORY REPORT

Samples: Seven (7) water samples
Date Received: 4-13-87
Purchase Order No: 41863B

Three of the samples were analyzed for volatile organic compounds by GCMS according to EPA method 624. The results are reported in the following Organics Analysis Data Results Sheets.

Page 1 of 1


Michael Shelton
Senior Chemist


D.J. Northington, Ph.D.
Technical Director

April 17, 1987

WOODWARD-CLYDE
203 N. Golden Circle Drive
Santa Ana, CA 92705

Attn: Allistair Callendar

JOB NO. 5664

WCA

**WEST COAST
ANALYTICAL
SERVICE, INC.**

ANALYTICAL CHEMISTS

LABORATORY REPORT

Samples: Forty (40) soil samples
Date Received: 4-10-87
Purchase Order No: Project 41863B

Fifteen (15) soil samples were analyzed for hydrocarbon content according to a modified EPA method 8015. The results are reported in the following table.

Page 1 of 2

B. Michael Horvath
for
Jim Bonde
Senior Chemist

D.J. Northington
D.J. Northington, Ph.D.
Technical Director

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE

SAMPLE: MW-1, A

ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED:	04/13/87	GCMS FILENAME:	5677V2
LEVEL:	LOW	MATRIX:	WATER
DATE PREPARED:	04/15/87	DATE ANALYZED:	04/15/87
STANDARD ID:	VOA457	INSTRUMENT ID:	5100
SAMPLE AMOUNT:	100UL		

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
74-87-3	CHLOROMETHANE	ND	300.
74-83-9	BROMOMETHANE	ND	300.
75-01-4	VINYL CHLORIDE	ND	300.
75-00-3	CHLOROETHANE	ND	300.
75-09-2	METHYLENE CHLORIDE	ND	500.
67-64-1	ACETONE	ND	500.
107-02-8	ACROLEIN	ND	500.
107-13-1	ACRYLONITRILE	ND	500.
75-15-0	CARBON DISULFIDE	ND	50.
75-35-4	1,1-DICHLOROETHENE	3700.	50.
75-34-3	1,1-DICHLOROETHANE	ND	50.
156-60-5	TRANS-1,2-DICHLOROETHENE	ND	50.
109-99-9	TETRAHYDROFURAN	ND	50.
75-69-4	TRICHLOROFLUOROMETHANE	ND	50.
76-13-1	FREON-TF	ND	50.
106-93-4	ETHYLENE DIBROMIDE	ND	50.
123-91-1	1,4-DIOXANE	ND	50.
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ND	50.
67-66-3	CHLOROFORM	ND	50.
107-06-2	1,2-DICHLOROETHANE	ND	50.
78-93-3	2-BUTANONE	ND	500.
71-55-6	1,1,1-TRICHLOROETHANE	260.	50.
16-23-5	CARBON TETRACHLORIDE	ND	50.
108-05-4	VINYL ACETATE	ND	300.
75-27-4	BROMODICHLOROMETHANE	ND	50.
79-34-5	1,1,2,2-TETRACHLOROETHANE	ND	50.
78-87-5	1,2-DICHLOROPROPANE	ND	50.
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ND	50.
79-01-6	TRICHLOROETHENE	5500.	50.
124-48-1	CHLORODIBROMOMETHANE	ND	50.
79-00-5	1,1,2-TRICHLOROETHANE	ND	50.
71-43-2	BENZENE	110.	50.
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	50.
110-75-8	2-CHLOROETHYL VINYLETHER	ND	500.
75-25-2	BROMOFORM	ND	50.
119-78-6	2-HEXANONE	ND	300.
108-10-1	4-METHYL-2-PENTANONE	ND	300.
127-18-4	TETRACHLOROETHENE	ND	50.
108-88-3	TOLUENE	ND	50.

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE

SAMPLE: MW-1, A

ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 04/13/87

LEVEL: LOW

DATE PREPARED: 04/15/87

STANDARD ID: VOA457

SAMPLE AMOUNT: 100UL

GCMS FILENAME: 5677V2

MATRIX: WATER

DATE ANALYZED: 04/15/87

INSTRUMENT ID: 5100

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
108-90-7	CHLOROBENZENE	ND	50.
100-41-4	ETHYLBENZENE	ND	50.
100-42-5	STYRENE	ND	50.
95-47-6	TOTAL XYLENES	ND	50.
108-41-8	M-CHLOROTOLUENE	ND	50.
541-73-1	1,3-DICHLOROBENZENE	ND	50.
106-46-7	1,4-DICHLOROBENZENE	ND	50.
95-50-1	1,2-DICHLOROBENZENE	ND	50.
120-82-1	1,2,4-TRICHLOROBENZENE	ND	50.

WCAS

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
SAMPLE: MW-1, A

TENTATIVELY IDENTIFIED COMPOUNDS

COMPOUND NAME

FRACTION CONCENTRATION
UG/L (PPB)

=====

1 NONE FOUND

VOA

WCAS

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
 SAMPLE: MW-1, B
 ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 04/13/87 GCMS FILENAME: 5677V3
 LEVEL: LOW MATRIX: WATER
 DATE PREPARED: 04/15/87 DATE ANALYZED: 04/15/87
 STANDARD ID: VDA457 INSTRUMENT ID: 5100
 SAMPLE AMOUNT: 100UL

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
74-87-3	CHLOROMETHANE	ND	300.
74-83-9	BROMOMETHANE	ND	300.
75-01-4	VINYL CHLORIDE	ND	300.
75-00-3	CHLOROETHANE	ND	300.
75-09-2	METHYLENE CHLORIDE	ND	500.
67-64-1	ACETONE	ND	500.
107-02-8	ACROLEIN	ND	500.
107-13-1	ACRYLONITRILE	ND	500.
75-15-0	CARBON DISULFIDE	ND	50.
75-35-4	1,1-DICHLOROETHENE	2500.	50.
75-34-3	1,1-DICHLOROETHANE	ND	50.
156-60-5	TRANS-1,2-DICHLOROETHENE	ND	50.
109-99-9	TETRAHYDROFURAN	ND	50.
75-69-4	TRICHLOROFLUOROMETHANE	ND	50.
76-13-1	FREON-TF	ND	50.
106-93-4	ETHYLENE DIBROMIDE	ND	50.
123-91-1	1,4-DIOXANE	ND	50.
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ND	50.
67-66-3	CHLOROFORM	ND	50.
107-06-2	1,2-DICHLOROETHANE	ND	50.
78-93-3	2-BUTANONE	ND	500.
71-55-6	1,1,1-TRICHLOROETHANE	120.	50.
16-23-5	CARBON TETRACHLORIDE	ND	50.
108-05-4	VINYL ACETATE	ND	300.
75-27-4	BROMODICHLOROMETHANE	ND	50.
79-34-5	1,1,2,2-TETRACHLOROETHANE	ND	50.
78-87-5	1,2-DICHLOROPROPANE	ND	50.
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ND	50.
79-01-6	TRICHLOROETHENE	3600.	50.
124-48-1	CHLORODIBROMOMETHANE	ND	50.
79-00-5	1,1,2-TRICHLOROETHANE	ND	50.
71-43-2	BENZENE	ND	50.
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	50.
110-75-8	2-CHLOROETHYL VINYLETHER	ND	500.
75-25-2	BROMOFORM	ND	50.
119-78-6	2-HEXANONE	ND	300.
108-10-1	4-METHYL-2-PENTANONE	ND	300.
127-18-4	TETRACHLOROETHENE	ND	50.
108-88-3	TOLUENE	ND	50.

WCAS

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
 SAMPLE: MW-1, B
 ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 04/13/87 GCMS FILENAME: 5677V3
 LEVEL: LOW MATRIX: WATER
 DATE PREPARED: 04/15/87 DATE ANALYZED: 04/15/87
 STANDARD ID: VOA457 INSTRUMENT ID: 5100
 SAMPLE AMOUNT: 100UL

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
108-90-7	CHLOROBENZENE	ND	50.
100-41-4	ETHYLBENZENE	ND	50.
100-42-5	STYRENE	ND	50.
95-47-6	TOTAL XYLENES	ND	50.
108-41-8	M-CHLOROTOLUENE	ND	50.
541-73-1	1,3-DICHLOROBENZENE	ND	50.
106-46-7	1,4-DICHLOROBENZENE	ND	50.
95-50-1	1,2-DICHLOROBENZENE	ND	50.
120-82-1	1,2,4-TRICHLOROBENZENE	ND	50.

WCAS

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
SAMPLE: MW-1, B

TENTATIVELY IDENTIFIED COMPOUNDS

COMPOUND NAME

FRACTION CONCENTRATION
UG/L (PPB)

=====

1 NONE FOUND

VOA

WCAS

April 2, 1987

WOODWARD-CLYDE
203 N. Golden Circle Drive
Santa Ana, CA 92705

Attn: Allistair Callendar

JOB NO. 5557


WCAAS
WEST COAST
ANALYTICAL
SERVICE, INC.
ANALYTICAL CHEMISTS


LABORATORY REPORT

Samples: One (1) water sample
Date Received: 3-27-87
Purchase Order No: 41863B

The sample was analyzed for volatile organic compounds by GCMS according to EPA method 624. The results are reported in the following Organics Analysis Data Results sheets.

Page 1 of 1


Michael Shelton
Senior Chemist


D.J. Northington, Ph.D.
Technical Director

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
 SAMPLE: TRIP BLANK
 ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 04/13/87 QCMS FILENAME: 5677V4
 LEVEL: LOW MATRIX: WATER
 DATE PREPARED: 04/15/87 DATE ANALYZED: 04/15/87
 STANDARD ID: VOA457 INSTRUMENT ID: 5100
 SAMPLE AMOUNT: 5.0ML

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
74-87-3	CHLOROMETHANE	ND	5.
74-83-9	BROMOMETHANE	ND	5.
75-01-4	VINYL CHLORIDE	ND	5.
75-00-3	CHLOROETHANE	ND	5.
75-09-2	METHYLENE CHLORIDE	ND	10.
67-64-1	ACETONE	ND	10.
107-02-8	ACROLEIN	ND	10.
107-13-1	ACRYLONITRILE	ND	10.
75-15-0	CARBON DISULFIDE	ND	1.
75-35-4	1,1-DICHLOROETHENE	ND	1.
75-34-3	1,1-DICHLOROETHANE	ND	1.
156-60-5	TRANS-1,2-DICHLOROETHENE	ND	1.
109-99-9	TETRAHYDROFURAN	ND	1.
75-69-4	TRICHLOROFLUOROMETHANE	ND	1.
76-13-1	FREON-TF	ND	1.
106-93-4	ETHYLENE DIBROMIDE	ND	1.
123-91-1	1,4-DIOXANE	ND	1.
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ND	1.
67-66-3	CHLOROFORM	ND	1.
107-06-2	1,2-DICHLOROETHANE	ND	1.
78-93-3	2-BUTANONE	ND	10.
71-55-6	1,1,1-TRICHLOROETHANE	ND	1.
16-23-5	CARBON TETRACHLORIDE	ND	1.
108-05-4	VINYL ACETATE	ND	5.
75-27-4	BROMODICHLOROMETHANE	ND	1.
79-34-5	1,1,2,2-TETRACHLOROETHANE	ND	1.
78-87-5	1,2-DICHLOROPROPANE	ND	1.
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ND	1.
79-01-6	TRICHLOROETHENE	ND	1.
124-48-1	CHLORODIBROMOMETHANE	ND	1.
79-00-5	1,1,2-TRICHLOROETHANE	ND	1.
71-43-2	BENZENE	ND	1.
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	1.
110-75-8	2-CHLOROETHYL VINYLETHER	ND	10.
75-25-2	BROMOFORM	ND	1.
119-78-6	2-HEXANONE	ND	5.
108-10-1	4-METHYL-2-PENTANONE	ND	5.
127-18-4	TETRACHLOROETHENE	ND	1.
108-88-3	TOLUENE	ND	1.

 WCA

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
 SAMPLE: TRIP BLANK
 ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 04/13/87 GCMS FILENAME: 5677V4
 LEVEL: LOW MATRIX: WATER
 DATE PREPARED: 04/15/87 DATE ANALYZED: 04/15/87
 STANDARD ID: VDA457 INSTRUMENT ID: 5100
 SAMPLE AMOUNT: 5.0ML

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
108-90-7	CHLOROBENZENE	ND	1.
100-41-4	ETHYLBENZENE	ND	1.
100-42-5	STYRENE	ND	1.
95-47-6	TOTAL XYLENES	ND	1.
108-41-8	M-CHLOROTOLUENE	ND	1.
541-73-1	1,3-DICHLOROBENZENE	ND	1.
106-46-7	1,4-DICHLOROBENZENE	ND	1.
95-50-1	1,2-DICHLOROBENZENE	ND	1.
120-82-1	1,2,4-TRICHLOROBENZENE	ND	1.

WCAS

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD CLYDE
SAMPLE: TRIP BLANK

TENTATIVELY IDENTIFIED COMPOUNDS

COMPOUND NAME

FRACTION CONCENTRATION
UG/L (PPB)

=====

1 NONE FOUND

VOA

WCA'S

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD-CLYDE
 SAMPLE: MW-1(41)A
 ANALYSIS TYPE: EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 03/27/87 GCMS FILENAME: 5557V3
 LEVEL: LOW MATRIX: WATER
 DATE PREPARED: 04/01/87 DATE ANALYZED: 04/01/87
 STANDARD ID: VOA280 INSTRUMENT ID: 5101
 SAMPLE AMOUNT: 100UL

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
74-87-3	CHLOROMETHANE	ND	300.
74-83-9	BROMOMETHANE	ND	300.
75-01-4	VINYL CHLORIDE	ND	300.
75-00-3	CHLOROETHANE	ND	300.
75-09-2	METHYLENE CHLORIDE	ND	500.
67-64-1	ACETONE	ND	500.
107-02-8	ACROLEIN	ND	500.
107-13-1	ACRYLONITRILE	ND	500.
75-15-0	CARBON DISULFIDE	ND	50.
75-35-4	1,1-DICHLOROETHENE	2800.	50.
75-34-3	1,1-DICHLOROETHANE	ND	50.
156-60-5	TRANS-1,2-DICHLOROETHENE	ND	50.
109-99-9	TETRAHYDROFURAN	ND	50.
75-69-4	TRICHLOROFLUOROMETHANE	ND	50.
76-13-1	FREDN-TF	ND	50.
106-93-4	ETHYLENE DIBROMIDE	ND	50.
123-91-1	1,4-DIOXANE	ND	50.
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ND	50.
67-66-3	CHLOROFORM	ND	50.
107-06-2	1,2-DICHLOROETHANE	ND	50.
78-93-3	2-BUTANONE	ND	500.
71-55-6	1,1,1-TRICHLOROETHANE	300.	50.
16-23-5	CARBON TETRACHLORIDE	ND	50.
108-05-4	VINYL ACETATE	ND	300.
75-27-4	BROMODICHLOROMETHANE	ND	50.
79-34-5	1,1,2,2-TETRACHLOROETHANE	ND	50.
78-87-5	1,2-DICHLOROPROPANE	ND	50.
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ND	50.
79-01-6	TRICHLOROETHENE	4600.	50.
124-48-1	DIBROMOCHLOROMETHANE	ND	50.
79-00-5	1,1,2-TRICHLOROETHANE	ND	50.
71-43-2	BENZENE	85	50.
10061-01-5	CIS-1,3-DICHLOROPROPENE	ND	50.
110-75-8	2-CHLOROETHYL VINYL ETHER	ND	500.
75-25-2	BROMOFORM	ND	50.
119-78-6	2-HEXANONE	ND	300.
108-10-1	4-METHYL-2-PENTANONE	ND	300.
127-18-4	TETRACHLOROETHENE	ND	50.
108-88-3	TOLUENE	ND	50.

WEST COAST ANALYTICAL SERVICE, INC

CLIENT: WOODWARD-CLYDE
SAMPLE: MW-1(41)A
ANALYSIS TYPE EPA METHOD 8240 (624)

ORGANICS ANALYSIS DATA RESULTS

DATE RECEIVED: 03/27/87 GCMS FILENAME: 5557V3
LEVEL: LOW MATRIX: WATER
DATE PREPARED: 04/01/87 DATE ANALYZED: 04/01/87
STANDARD ID: VOA280 INSTRUMENT ID: 5101
SAMPLE AMOUNT: 100UL

CAS #	COMPOUND	CONC: UG/L (PPB)	DETECTION LIMIT
108-90-7	CHLOROBENZENE	ND	50
100-41-4	ETHYLBENZENE	ND	50
100-42-5	STYRENE	ND	50
95-47-6	TOTAL XYLENES	ND	50
108-41-8	M-CHLOROTOLUENE	ND	50
95-50-1	1,2-DICHLOROBENZENE	ND	50
541-73-1	1,3-DICHLOROBENZENE	ND	50
106-46-7	1,4-DICHLOROBENZENE	ND	50
120-82-1	1,2,4-TRICHLOROBENZENE	ND	50

WEST COAST ANALYTICAL SERVICE, INC.

CLIENT: WOODWARD-CLYDE
SAMPLE: MW-1(41)A

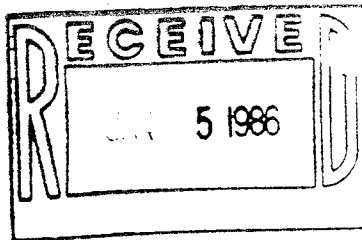
TENTATIVELY IDENTIFIED COMPOUNDS

COMPOUND NAME	FRACTION	CONCENTRATION UG/L (PPB)
=====		
1 NONE FOUND	VOA	

Data Reporting Qualifiers

- Value - If the result is a value greater than or equal to the Detection Limit (DL), the value is reported.
- ND - Indicates that the compound was analyzed for but not detected. The minimum DL for the sample with the ND is reported based on necessary concentration or dilution actions.
- TR - Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified DL but greater than zero.

December 31, 1986



WOODWARD-CLYDE
203 No. Golden Circle Drive
Santa Ana, CA 92705

WCAS
WEST COAST
ANALYTICAL
SERVICE, INC.
ANALYTICAL CHEMISTS

Attn: Kevin Gibson

JOB NO. 4932

LABORATORY REPORT

Samples: Two (2) soil samples
Date Received: 12-29-86
Purchase Order No: Project 41863B

The samples were analyzed for total petroleum hydrocarbon content using EPA method 418.1. The results are listed below:

Parts Per Million

<u>Sample No.</u>	<u>Total Petroleum Hydrocarbons</u>
B2-2-3 at 5'	5000
B2-7-3 at 30'	6000
Detection Limit	10

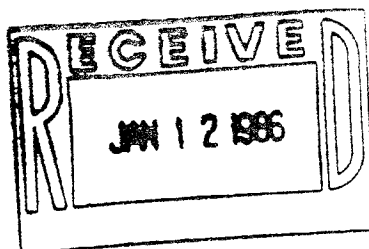
Date Analyzed: 12-30-86

Page 1 of 1

Isabella P. Gundran
Isabella Gundran
Chemist

D.J. Northington
D.J. Northington, Ph.D.
Technical Director

January 9, 1987



WOODWARD-CLYDE
203 N. Golden Circle Drive
Santa Ana, CA 92705

WCAS

**WEST COAST
ANALYTICAL
SERVICE, INC.**

ANALYTICAL CHEMISTS

Attn: Kevin Gibson

JOB NO. 4968

LABORATORY REPORT

Samples: Nineteen (19) soil samples
Date Received: 1-6-87
Purchase Order No: 41863B

Ten (10) samples were analyzed for total petroleum hydrocarbons by EPA method 418.1. The results are reported below:

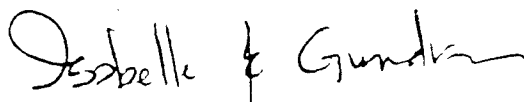
Parts Per Million


<u>Sample.No.</u>	<u>Total Petroleum Hydrocarbons</u>
2-7-4	14000
2-8-4	2000
2-9-4	2000
2-10-4	19000
3-1-4	2900
3-2-4	27
3-3-4	1200
3-4-4	4400
3-5-3	13000
3-6-3	4100
Detection Limit	10

Date Extracted: 1-8-87

Date Analyzed: 1-8-87

Page 1 of 1


Isabelle Gundran
Chemist.


D.J. Northington, Ph.D.
Technical Director

APPENDIX C

CHAIN-OF-CUSTODY FORMS

PAGE 1 OF 1

DATE 3 / 27 / 87

PROJECT NAME:

PROJECT NO.:

Douglas-Terrance
418638

NOTE: Allow
All sediment to
settle out before
taking Analysis
sample.

Total Number of Samples Shipped: 5

Sampler's Signature: _____

Brian Jacob

Relinquished By: Bryan Jacobs
Signature _____
Printed Name Bryan Jacobs
Company Woodward - Clyde
Reason Analysis

Received By: _____
Signature _____
Printed Name _____
Company _____

Date
327/87

Time
5:42 pm

Relinquished By: _____
Signature _____
Printed Name _____
Company _____
Reason _____

Received By: _____
Signature _____
Printed Name _____
Company _____

Date
/ /

Time

Relinquished By: _____
Signature _____
Printed Name _____
Company _____
Reason _____

Received By: _____
Signature _____
Printed Name _____
Company _____

Date

Time

Relinquished By: _____
Signature _____
Printed Name _____
Company _____
Reason _____

Received By: _____
Signature _____
Printed Name _____
Company _____

Date

Time

Special Shipment: Handling Storage Requirements:

* Note – This does not constitute authorization to proceed with analysis.

LA OR-0183-421

CHAIN OF CUSTODY RECORD

PROJECT NAME:

Douglas Aircraft C6DATE 12 1291 86

PROJECT NO.:

418638

Sample Number	Location	Type of Sample		Type of Container	Type of Preservation		Analysis Required*
		Material	Method		Temp	Chemical	
B2-1-3 B2-1-4	B2 B2 1'	SOIL	CANAD	BRASS TUBE	ICE		HOLD HOLD
B2-2-3 B2-2-4	5'						EPA 418.1 HOLD
B2-3-3 B2-3-4	10'						HOLD "
B2-4-3 B2 4-4	15'						HOLD "
B2 5-3 B2 5-4	20'						HOLD "
B2 7-3 B2 6-3	30'						EPA 418.1 HOLD
B2 6-4 B2 5-4	25'						HOLD EPA 418.1
B2 7-4	30'						HOLD EPA 418.1

Total Number of Samples Shipped: 12Sampler's Signature: Kevin R. Gibbs

Relinquished By:

Signature Kevin R. Gibbs
 Printed Name KEVIN R. GIBBS
 Company WCC
 Reason TESTING

Received By:

Signature Shelly Runkel
 Printed Name Shelly Runkel
 Company WCAS

Date

12/29/86

Time

3:20

Relinquished By:

Signature _____
 Printed Name _____
 Company _____
 Reason _____

Received By:

Signature _____
 Printed Name _____
 Company _____

Date

1/1

Time

Relinquished By:

Signature _____
 Printed Name _____
 Company _____
 Reason _____

Received By:

Signature _____
 Printed Name _____
 Company _____

Date

1/1

Time

Relinquished By:

Signature _____
 Printed Name _____
 Company _____
 Reason _____

Received By:

Signature _____
 Printed Name _____
 Company _____

Date

1/1

Time

Special Shipment / Handling / Storage Requirements:

Please hold samples as noted above until told to do otherwise which will be done w/in 3 working days of receipt of report.

* Note - This does not constitute authorization to proceed with analysis



CHAIN OF CUSTODY RECORD

PROJECT NAME: DOUGLAS AIRCRAFTDATE 11/6/87PROJECT NO.: 41863D# 4968

Sample Number	Location	Type of Sample		Type of Container	Type of Preservation		Analysis Required*
		Material	Method		Temp	Chemical	
-2-7-3	B-2	Soil		Barstue	ICE		HOLD
-2-7-4							E.P.A. 418.1, T.P.H.C.
-2-8-3							HOLD
-2-8-4							418.1, T.P.H.C.
-2-9-3							HOLD
-2-9-4							418.1, T.P.H.C.
-2-10-4							418.1, T.P.H.C.
-3-1-3	B-3						HOLD
-3-1-4							418.1 T.P.H.C.
-3-2-3							HOLD
-3-2-4							418.1 T.P.H.C.
-3-3-3							HOLD
-3-3-4							418.1 T.P.H.C.
-3-4-3							HOLD
-3-4-4							418.1 T.P.H.C.
-3-5-2							HOLD
-3-5-3							418.1 T.P.H.C.
-3-6-2							HOLD
-3-6-3							418.1 T.P.H.C.

Total Number of Samples Shipped: 19Sampler's Signature: Kevin R. Gibson

Relinquished By: Kevin R. Gibson
Signature: Kevin R. Gibson
Printed Name: KEVIN R. GIBSON
Company: WCC
Reason: TESTING

Received By: Margaret Felt
Signature: Margaret Felt
Printed Name: Margaret Felt
Company: WCAS

Date

11/6/87

Time

4:15pm

Relinquished By: _____
Signature: _____
Printed Name: _____
Company: _____
Reason: _____

Received By: _____
Signature: _____
Printed Name: _____
Company: _____

Date

____/____/____

Time

____:____:____

Relinquished By: _____
Signature: _____
Printed Name: _____
Company: _____
Reason: _____

Received By: _____
Signature: _____
Printed Name: _____
Company: _____

Date

____/____/____

Time

____:____:____

Relinquished By: _____
Signature: _____
Printed Name: _____
Company: _____
Reason: _____

Received By: _____
Signature: _____
Printed Name: _____
Company: _____

Date

____/____/____

Time

____:____:____

Special Shipment Handling Storage Requirements: _____

* Note - This does not constitute authorization to proceed with analysis